The opinion in support of the decision being entered today was **not** written for publication and is **not** precedent of the Board.

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte THEODORE R. BECK

Appeal No. 2004-1043
Application No. 09/960,907

ON BRIEF

Before TIMM, JEFFREY T.SMITH and PAWLIKOWSKI, **Administrative Patent Judges**.

PAWLIKOWSKI, **Administrative Patent Judge**.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134 from the examiner's final rejection of claims 1-43.

Claims 1, 10, 18, 27 and 35 are representative of the subject matter on appeal and are set forth below:

> 1. An improved method of producing aluminum in an electrolytic cell containing alumina dissolved in an electrolyte, the method comprising the steps of:
>
> (a) providing a molten salt electrolytic at a temperature less than 900°C having alumina dissolved therein in an

electrolytic cell having a metallic liner which is anodic for containing said electrolyte, said liner having a bottom and walls extending upwardly from said bottom, said liner being substantially inert with respect to said molten electrolyte;

(b) providing a plurality of non-consumable anodes and cathodes disposed in said electrolyte;

(c) passing an electric current through said liner and anodes through said electrolyte to said cathodes, depositing aluminum on said cathodes, and generating oxygen bubbles at the anodes, said bubbles stirring said electrolyte;

(d) periodically reducing electric current flow to said cell for extended periods; and

(e) maintaining said electrolyte and aluminum in said cell in a molten condition during said extended periods of reduced current flow by application of heat to said bottom for purposes of heating said cell.

10. A method of efficiently operating a low temperature cell for the electrolytic production of aluminum from alumina dissolved in a molten salt electrolyte in a manner which is regulated to consume electrical power in a more cost-effective basis, the method comprising the step of:

(a) providing a molten salt electrolyte at a temperature less than 900°C having alumina dissolved therein in an electrolytic cell having a metallic liner which is anodic for containing said electrolyte, said liner having a bottom and walls extending upwardly from said bottom, said liner being substantially inert with respect to said molten electrolyte;

(b) providing a plurality of non-consumable anodes disposed substantially vertically in said electrolyte and a plurality of cathodes disposed vertically in said electrolyte, said anodes and said cathodes arranged in alternating relationship;

(c) passing an electric current through said liner and anodes sand through said electrolyte to said cathodes, depositing aluminum on said cathodes, and generating oxygen bubbles at the anodes, said bubbles stirring said electrolyte;

(d) periodically reducing electric current flow to said cell for extended periods; and

(e) maintaining said electrolyte and aluminum in said cell in a molten condition during said extended periods of reduced current flow by application of heat to said bottom for purposes of heating said cell.

18. An improved method of producing aluminum in an electrolytic cell containing alumina dissolved in an electrolyte, the method comprising the steps of:

(a) providing a molten salt electrolyte at a temperature less than 900°C having alumina dissolved therein in an electrolytic cell having a metallic liner which is anodic for containing said electrolyte, said liner having a bottom having an outside surface and having walls extending upwardly from said bottom, said liner being substantially inert with respect to said molten electrolyte;

(b) providing a plurality of non-consumable anodes and cathodes disposed in said electrolyte;

(c) passing an electric current through said liner and anodes and through said electrolyte to said cathodes, depositing aluminum on said cathodes, and generating oxygen bubbles at the anodes, said bubbles stirring said electrolyte;

(d) removing heat from said cell through said bottom of said liner by passing an air sweep from outside said cell over said outside surface of said bottom to remove heat from said bottom to provided a heated air sweep; and

(e) discharging said heated air sweep to the atmosphere outside said cell thereby maintaining said cell at said temperature.

27. A method of efficiently operating a low temperature cell for the electrolytic production of aluminum from alumina dissolved in a molten salt electrolyte in the method comprising the steps of:

(a) providing a molten salt electrolyte at a temperature less than 900°C having alumina dissolved therein in an electrolytic cell having a metallic liner which is anodic for containing said electrolyte, said liner having a bottom having an outside surface and have wall extending upwardly from said bottom, said liner being substantially inert with respect to said molten electrolyte;

(b) providing a plurality of non-consumable anodes disposed substantially vertically in said electrolyte and a plurality of cathodes disposed vertically in said electrolyte, said anodes and said cathodes arranged in alternating relationship;

(c) passing an electric current through said liner and anodes and through said electrolyte to said cathodes, depositing aluminum on said cathodes, and generating oxygen bubbles at the anodes, said bubbles stirring said electrolyte;

(d) removing heat from said cell through said bottom of said liner by passing an air sweep over said outside surface of said bottom to provide a heated air sweep;

(e) discharging said heated air sweep outside said cell;

(f) sensing the temperature of said electrolyte to provide a reading;

(g) relying said reading to a controller;

(h) in said controller, comparing said reading to a set reading to provide a comparison; and

(i) in response to said comparison, increasing, decreasing or maintaining air flow rate in said air sweep to maintain said cell at temperature.

35. An improved method for startup of a low temperature, electrolyte cell for producing aluminum from alumina dissolved in an electrolyte at less than 900°C, the method comprising the steps of:

(a) providing an electrolytic cell having a metal liner for containing electrolyte, said liner having a bottom having an outside surface and having walls extending upwardly from said bottom;

(b) providing a plurality of non-consumable anodes and cathodes disposed in said electrolyte;

(c) adding solid electrolyte and alumina to said cell;

(d) placing at least one heater adjacent said outside of said bottom;

(e) adding heat to said bottom until said solid electrolyte is melted; and

(f) when said electrolyte is in molten form, passing an electric current through said anodes and through said electrolyte to said cathodes, thereby depositing aluminum at said cathodes and generating oxygen bubbles at the anodes.

The examiner relies on the follow references as evidence of unpatentability:

Weaver	2,062,340	Dec. 01, 1936
Steiger et al. (Steiger)	4,181,583	Jan. 01, 1980
Beck et al. (Beck)	4,865,701	Sep. 12, 1989
Berclaz	WO 98/531120	Nov. 26, 1998

Beck, T.R., "A Non-Consumable Metal Anode For Production Of Aluminum With Low-Temperature Fluoride Melts" (1995), pp. 355-360.

Claims 1-3, 6-12, 15-20, 23-29 and 32-34 stand rejected under 35 U.S.C. § 103 as being unpatentable over Beck in view of Weaver and in view of Berclaz.

Claims 4, 5, 13, 14, 21, 22, 30, 31 and 39 stand rejected under 35 U.S.C. § 103 as being unpatentable over Beck (an non-consumable metal anode for production of aluminum with low-temperature fluoride melts) in view of Weaver, and in view of Berclaz, and further in view of Beck (U.S. Patent 4,865,701).

Claims 35-37 and 40-43 stand rejected under 35 U.S.C. § 103 as being unpatentable as being unpatentable over Beck in view of Steiger and in view of Berclaz.

Claims 38 and 39 stand rejected under 35 U.S.C. § 103 as being unpatentable over Beck in view of Steiger and view of Berclaz and further in Beck (U.S. Patent 4,865,701).

On page 5 of the Brief, appellant states that claims 18-34 and 35-43 are claims of different scope from claims 1-17. Upon our review of appellant's brief and reply brief, we observe that appellant argues claims 1, 10, 18, 27, and 35 separately. We accordingly considered these claims in this appeal. 37 CFR § 1.192(c)(7 and 8)(2003).

OPINION

Beginning on page 18 of brief, appellant argues that the Beck paper is silent with respect to providing periods with of reduced electrical current flow. At the top of page 19 of the brief, appellant argues that the invention provides that during periods of reduced current flow, electrolyte and aluminum are kept molted by applications of heat to the bottom of the cell. Appellant also argues that the invention requires a plurality of anodes. With regard to claims 18 and 27, appellant argues that these claims require removal of heat from the cell by passing an air sweep from outside the cell over the bottom of the cell and discharging the heated air outside the cell. Appellant argues the Beck paper cell with respect this aspect of the claimed invention.

Appellant further argues with regard to claim 27 that claim 27 requires controlling the temperature of electrolyte using the controller which increases or decreases the air sweep to control of the temperature in the cell. Beginning on page 20 of the brief, appellant discusses the Weaver reference. Appellant argues that with regard to claims 1 and 10, these claims are patentable over the combination of the Beck Paper in view of Weaver. Appellant argues that Weaver does not employ a metallic liner but instead employs a double refractory liner denoted as 6 and 7. Appellant argues that because Weaver does not employ a metallic liner claims 1 and 10 are patentable over Weaver. Appellant further argues that claims 1 and 10, heat is supplied to the metallic bottom during periods of reduced current flow in order to maintain the electrolyte and aluminum in a molten condition. Appellant argues that Weaver heats by burning combustible material with a hollow, cylindrical anode located on top of the electrolyte. Appellant argues that this is different from the claimed invention. (Brief, page 20 and 21).

Appellant further argues that claims 1 and 10 are patentable of the Beck paper and Weaver because the invention requires a plurality of non-consumable anodes and cathodes to disposed in the electrolyte. Appellant argues that Weaver only discloses a layer of molten aluminum 13 as the cathode. Appellant states that clearly Weaver is concerned with a different electrolytic cell employing a molten cathode and is not concerned with non-consumable cathodes as required by appellant's claims. Thus, for this reason, appellant argues that the invention is patentable over Weaver. Appellant further argues that Weaver discloses and requires the use of a hollow anode whereas and the claimed does not. At the bottom of page 21, appellant states that the invention does not use a hollow anode that rotates to produce agitation. Appellant argues that the claim provide for agitation by generating oxygen levels when electric current is passed through liner. On page 22 of the brief, appellant further argues that Weaver requires the hollow anode for purposes of heating or cooling the electrolyte. Appellant states that the invention as claimed the anode does not function in this way; that is, heat is added or removed through the metallic cell bottom. Appellant states that thus even if combined with Beck, appellant's invention is patentable over Weaver.

Appellant further argues that with regard to claims 18 and 27, Weaver is silent with respect the use of an air sweep on the bottom of the cell. On pages 22-23 of the brief, appellant concludes therefore that the combination of the Beck paper in view of Weaver does not suggest the claimed invention. Appellant also argues that there is no suggestion when essential steps of appellant's invention are missing in the references.

Beginning on page 23 of the brief, appellant argues the Berclaz reference. Appellant submits that the Berclaz reference is concerned with a different cell than that of appellant. Appellant states that the claimed metallic liner which is at anodic potential having a bottom to which is applied heat for purposes of heating the cell during period of reduced current flow. Appellant states that

Berclaz does not have a metallic liner held at anode potential. Appellant states that Berclaz is silent with respect to passing electric current through the metallic liner and anodes through to the cathodes. Appellant further argues that Berclaz describes in metallic cell 31 for the cathode material. Appellant states that Berclaz discloses that the metal shell holds cathode material and is held at cathode potential. At the bottom of page 24 of the brief, appellant further argues that Berclaz differs from the claimed invention and that Berclaz indicates that heating and cooling is provided to adjust the temperature of the cathode. At the top of page 25 of the brief, appellant states that thus the heat is applied to the cathode at start-up to pre-heat the cathode or, the cathode is cooled during operation to perform a protective paste. Appellant argues in his invention, heat is supplied to the bottom of the cell (not to the cathode) to keep the electrolyte molten under reduced current operation or heat is removed though the bottom to control the temperature of electrolyte during operation. Appellant argues that in his invention, heat is added and removed from through the metal bottom of the cell and this is not disclosed in Berclaz. Finally, appellant argues that Berclaz is concerned with the different type of electrolytic cell. (Brief, page 25). On pages 26-33, appellant sets forth further in view arguments regarding the rejection over the Beck article and in view Weaver and further Berclaz (Items e, d, f, and g). We have carefully reviewed this aspect of the brief.

II. <u>The examiner’s position</u>

Regarding claims 1,10,18 and 27, Beck discloses a method for producing aluminum comprising the following steps (see entire document):

(a) Providing a molten salt electrolyte at a temperature less than 900°C having alumina dissolved therein in an electrolytic cell having an anodic liner, wherein the liner has walls and a bottom and is substantially inert to the electrolyte;

(b) Providing a plurality of non-consumable anodes and cathodes disposed in the electrolyte;

(c) Passing an electric current through the anodes and through the electrolyte to the cathodes, depositing aluminum on the cathodes and. generating oxygen bubbles that stir the electrolyte.

Regarding claims 2, 11, 19 and 28, Beck discloses the use of an electrolyte temperature of 750°C (abstract).

Regarding claims 3, 12, 20 and 29, Beck discloses the use of alkali metal fluorides in the bath including NaF (introduction).

Regarding claims 8, 15, 23 and 32, Beck uses anodes and an anodic liner made of Cu-Ni-Fe alloy (p. 359, col.1).

Regarding claims 7, 16, 24 and 33, Beck provides an example of a cell operated at 0.5 A/cm^2 (p. 359, col. 2).

Regarding claims 8, 17, 25 and 34, Beck discloses the use of titanium diboride cathodes (abstract).

The method of Beck differs from the instant invention because Beck does not disclose the following:

> a. Periodically reducing the electric current flow to the cell and applying heat to the bottom of the cell to maintain the bath in a molten state, as recited in claims 1 and 10;

b. A plurality of anodes and a plurality of cathodes, as recited in claims 9,10, 26 and 27;

b. Removing heat from the cell through the bottom of the liner by passing air over the outside-surface of the bottom and discharging the air, as recited in claims 18 and 27; and

c. Controlling the temperature of the electrolyte using a controller, as recited in claim 27.

Regarding claims 1 and 10, Weaver discloses a method and apparatus for producing aluminum wherein the temperature is controlled to maintain a preferred bath temperature and also to operate when "off peak power" can be used. Weaver uses a hollow anode, through which a cooling fluid is passed to prevent the temperature from exceeding the desired temperature range (page 3, col. 2, lines 53-6O). Weaver also discloses that the electrolysis can be performed "as an intermittent operation with 'off peak power'. . . [where] the anode can be heated by burning combustible material there within to prevent the freezing of the bath" (page 3, col. 2, lines 61-74).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Beck to operate the cell intermittently while maintaining the bath in a molten state as taught by Weaver because operating the cell only during "off peak power" times reduces the operating cost of the operation.

Regarding claims 1, 10, 18 and 27, Berclaz discloses a method for producing aluminum using a cell that has an air space 52 to adjust the temperature of the cell by supplying heating or cooling gas to the space 52 (page 26, lines 25-36; fig. 6). When a gas is not passed through the space 52, the space acts as a thermal insulating space (page 26, lines 25-29).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the temperature control pipes in the cell used by Beck to use heating or cooling gas to control the temperature as taught by Berclaz because using heating or cooling gas allows the temperature of the cell to be controlled and also provides thermal insulation in the form of an air space when heating or cooling is not necessary.

Regarding claims 9, 10, 26 and 27, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the cell of Beck to use a plurality of cathodes because using a plurality of cathodes and a plurality of anodes increases the amount of aluminum that can be produced.

Regarding claim 27, Weaver maintains "a proper temperature control within very close limits" by using a temperature sensor and controller (page 4, col.1, lines 1-26).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method of Beck to use a sensor and controller as taught by Weaver because the sensor and controller allows the temperature to be maintained within very close limits.

II. Claims 4, 5, 13, 14, 21, 22, 30, 31 and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Beck ("A NON-CONSUMABLE METAL ANODE FOR PRODUCTION OF ALUMINUM WITH LOW-TEMPERATURE FLUORIDE MELTS," Light Metals 1995, pp. 355-360) in view of Weaver (U.S. Pat. No. 2,062,340) and in view of Berclaz (WO 98/53120), as applied above to claims 1-3, 6-12, 15-20, 23-29 and 32-34, and further in view of Beck et al. (U.S. Pat. No. 4,865,701).

Beck, Weaver and Berclaz describe a method having the limitations recited in claims 1-3, 6-12, 15-20, 23-29 and 32-34, of the instant invention, as described above in section I.

The method described by Beck, Weaver and Berclaz teaches the electrolytic formation of aluminum from alumina, differs from the instant invention because they do not teach the use of 0.2 to 30 wt.% undissolved alumina particles, as recited in claims 4, 13, 21 and 30, and the undissolved alumina particles have a particle size in the range of 1 to 100 µm, as recited in claims 5, 14, 22, 31 and 39.

Regarding claims 4, 13, 21 and 30, Beck et al. disclose the use of excess alumina at a concentration within the claimed range of 0.2 to 30 wt.% undissolved alumina particles (col. 6, lines 1-12).

Regarding claims 5, 14, 22, 31 and 39, Beck et al. disclose the use of alumina particles having a diameter up to 100 µm (col. 5, lines 1-8).

Beck et al. disclose the use of alumina particles in the slurry having a concentration of alumina particles within the range claimed in claim 38 of the instant application (col. 6, lines 1-12). Beck et al. also disclose the use of alumina particles having a size of 100 µm or less and teach, "the smaller the alumina particles, the less the tendency to settle out on the bottom of the cell (col. 5, lines 1-8). An undissolved alumina supply is maintained to "provide a ready supply of undissolved alumina for further dissolution [adjacent the anode]" (col. 3, lines 11-22).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Beck, Steiger et al. and Berclaz to use alumina particles having the size and concentration as taught by Beck et al. because the alumina particles bf that size will not settle to the bottom of the cell and provide cell protection provided by that concentration, while also providing a ready supply of alumina for dissolution.

III. Claims 35-37 and 40-43 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beck ("A NON-CONSUMABLE METAL ANODE FOR PRODUCTION OF ALUMINUM WITH LOW-TEMPERATURE FLUORIDE MELTS," Light Metals 1995, pp. 355-360) in view of Steiger et al. (U.S. Pat. No. 4,181,583) and in view of Berclaz (WO 98/53120).

Regarding claim 35, Beck discloses a method for producing aluminum comprising the following steps (see entire document):

(a) Providing a molten salt electrolyte at a temperature less than 900°C having alumina dissolved therein in an electrolytic cell having an anodic liner, wherein the liner has walls and a bottom and is substantially inert to the electrolyte;

(b) Providing a plurality of non-consumable anodes and cathodes disposed vertically in the electrolyte;

(c) Heating the cell up to operating temperature and completely melting the electrolyte; and

(d) Passing an electric current through the anodes and through the electrolyte to the cathodes, depositing aluminum on the cathodes and generating oxygen bubbles that stir the electrolyte.

Regarding claim 36, Beck discloses the use of an electrolyte temperature of 750°C (abstract).

Regarding claim 37, Beck discloses the use of alkali metal fluorides in the bath including NaF (introduction).

Regarding claim 40, Beck uses anodes and an anodic liner made of Cu-Ni-Fe alloy (p. 359, col.1).

Regarding claim 41, Beck provides an example of a cell operated at 0.5 A/cm^2 (p. 359, col. 2).

Regarding claim 42, Beck discloses the use of titanium diboride cathodes (abstract).

Regarding claim 43, the anodes and cathode are disposed in an alternating relationship (fig. 10).

The method of Beck differs from the instant invention because Beck does not disclose the following:

a. Adding solid electrolyte and alumina to the cell, as recited in claim 35;

b. Placing a heater adjacent to the bottom of the liner and adding heat to the bottom until the electrolyte until it is melted, as recited in claim 35; and

c. A plurality of anodes and a plurality of cathodes, as recited in~clairn 43;

Steiger et al. disclose a method for producing aluminum, wherein the startup method includes the steps of either charging the cell with molten electrolyte or charging the cell before pre-heating with solid electrolyte, which melts as the cell is heated to its operating temperature (col. 13, lines 5-13). When solid electrolyte is added, the cell is heated using heaters placed on the bottom of the cell.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the startup method of Beck to add solid electrolyte to the cell and heating it up to melt the electrolyte as taught by Steiger et al. because Steiger et al. demonstrate that the method of charging the cell with molten electrolyte and melting a charge of solid electrolyte within the cell during heat-up can be used equivalently.

Regarding claim 35, Berclaz discloses a method for producing aluminum using a cell that has an air space 52 to adjust the temperature of the cell by supplying heating or cooling gas to the space 52 (page 26, lines 5-36; fig. 6). When a gas is not passed through the space 52, the space acts as a thermal insulating space (page 26, lines 25-29). Further, Berclaz discloses, "during cell start up, the cathode 30 can be heated by passing hot gas through space 52" (p. 26, lines 32-33).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the cell start up method used by Beck to use heating gas to heat the cell at start up as taught by Berclaz because using a heating gas positioned below the cell allows the temperature of the cell to be controlled and also provides thermal insulation in the form of an air space when heating or cooling is not necessary.

IV. Claims 38-39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beck ("A NON-CONSUMABLE METAL ANODE FOR PRODUCTION OF ALUMINUM WITH LOW-TEMPERATURE FLUORIDE MELTS," Light Metals 1995, pp. 355-360) in view of Steiger et al. (U.S. Pat. No. 4,181,583) and in view of Berclaz (WO 98153120), as applied above to claims 35-37 and 40-43, and further in view of Beck et al. (U.S. Pat. No. 4,865,701). (Although claim 39 depends from claim 2, it is treated in this section as though it depended from claim 35, as explained in the Office action mailed December 12, 2002. Since Applicant has not changed the dependency from claim 2, but has referred to as part of the group consisting of claims 35-43 in section VII on page 5 of Applicant's Appeal Brief, the claim has been treated for both possibilities as it has been treated since the first Office action.)

Beck, Steiger et al. and Berclaz describe a method having the limitations recited in claims 35-37 and 40-43 of the instant application, as explained above in section Ill.

The method described by Beck, Steiger et al. and Berclaz differs from the instant invention because they do not disclose the concentration of the alumina in the slurry, as recited in claim 38, or the size of the alumina particles, as recited in claim 39.

Beck et al. disclose the use of alumina particles in the slurry having a concentration of al umina particles within the range claimed in claim 38 of the instant application (col. 6, lines 1-12). Beck et al. also disclose the use of alumina particles having a size of 100 µm or less and teach, "the smaller the alumina particles, the less the tendency to settle out on the bottom of the cell" (Col. 5, lines 1-8).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the method described by Beck, Steiger et al. and Berclaz to use alumina particles having the size and concentration as taught by Beck et al. because the alumina particles of that size will not settle to the bottom of the cell and provide cell protection provided by that concentration.

(11) Response to Arguments

A. The Beck Paper (XII.A, pages 18-19)

i. The Beck paper is silent to the claimed periods of reduced electrical current flow to the cell (XII.A, page 18) and the application of heat to the bottom of the cell liner during periods of reduced current flow (XII.A, page 19)

Regarding claims 1-17, the Examiner acknowledges that the primary reference of Beck does not teach the periodic reduction of current flow to the cell and the application of heat during the periods of reduced current flow. However, the Examiner deems that these steps would have been obvious to one having ordinary skill in the art at the time the invention was made in view of the secondary references.

ii. The Beck paper is silent to a plurality of anodes (XII.A, page 19)

Regarding claims 1-43, although Beck does not expressly disclose providing a plurality of anodes, in the Abstract on page 355, Beck discloses:

> Operation with multiple, vertical, monopolar, metal anodes and TiB_2 plate cathodes at 0.5 A/cm^2 each side promises a 20-fold decrease in cell volume compared to conventional [Hall-Heroult] cells. (Abstract, p. 355)

Thus, the Beck paper provides a strong suggestion for the use of a plurality of anodes and a plurality of cathodes. Additionally, the use of a plurality of anodes and a plurality of cathodes would have been obvious to one of ordinary skill in the art at the time the invention was made because the use of a plurality of anodes and cathodes increases the total surface area exposed to the electrolyte, thus increasing the amount of aluminum that could be produced.

iii. The Beck paper is silent to the removal of heat from the cell using an airsweep (XII.A, page 19) and to using a controller to control an airsweep to control the temperature of *the cell (XII.A, page 19)*

The Examiner acknowledges that the Beck paper does not expressly teach the removal of heat from the cell using an airsweep, as recited in claims 18-34, or the use of a controller to control the airsweep, as recited in claims 27-34. However, the Examiner deems that it would have been obvious to one having ordinary skill in the art at the time the invention was made to have removed heat from the cell using an airsweep and a controller to control the airsweep in view of the secondary references.

B. The Weaver Reference

i. The instant invention is *patentable over the combination of the Beck paper and the Weaver reference due to differences in structure (XII. B, pages 2U-23)*

Appellant has argued several structural differences between the cell used in the, Beck paper and the cell taught by Weaver, including differences in electrode structure and heating structure.

Beck teaches a method for the electrolytic production of aluminum from alumina. Beck teaches the structure of the electrolytic cell, including the orientation and structure of the anodes and cathodes, as well as the use of an anodic liner (figs. 9-11). Like Beck, Weaver also teaches the electrolytic production of aluminum from alumina using anodes and cathodes.

Regarding claims 1-17, the Weaver reference also teaches a method of advantageously using off-peak power by intermittently operating the electrolytic cell and applying heat to prevent the freezing of the bath when the power is not supplied (see US ‘340, p. 3, col. 2, lines 61-74). Therefore, one of ordinary skill in the art would have been motivated to operate the, electrolytic cell of Beck intermittently to take advantage of off-peak power as taught by Weaver. One skilled in the art would have heated the electrolyte to maintain the electrolyte in molten state as taught by Weaver to "prevent the freezing of the bath to a hard stone-like substance which would cause damage to the interior of the cell, until such a time as the power is again available" (see US ‘340, p. 3, col. 2, lines 61-74).

One skilled in the art would recognize that the method disclosed by Weaver is not limited to any one structure, insofar as the structure is capable of performing the same method. The reference of Weaver is relied upon to teach a method for operating an electrolytic cell intermittently and applying heat to maintain the electrolyte in a molten state. As seen in the Beck paper on page 359, the method requires the application of heat to melt the electrolyte (heat-up) and the operation of the cell at a current for a fixed time (set periods of current flow) (see Beck, p. 359, col. 2). Therefore, the apparatus of Beck is capable of performing the method as taught by Weaver.

Regarding claims 18-34, Appellant has argued structural differences between the cell of the Beck paper and the Weaver reference in the removal of heat (see Appellant’s Brief, p. 22).

The Examiner acknowledges that Weaver does not teach an airsweep passing over the outside bottom of the liner. However, Weaver does teach the removal of heat using a cooling fluid to prevent the temperature of the bath from rising too high (see US ‘340, p. 3, col. 2, lines 52-60).

On page 22 of Appellant’s brief, Appellant states, "Weaver is *silent with* respect to an air sweep on the bottom of the cell, and thus Applicant’s invention as set forth in claims 1 and 10 or 18 and 27 is patentable over this combination" (see Appellant’s Brief, p. 22, second full paragraph). This statement is inaccurate because claims 1 and 10 do not limit the structure of the cell to having an air sweep on the bottom of the cell.

Specifically, claims 1 and 10 recite the following limitation:

> (e) maintaining said electrolyte and aluminum in said cell in a molten condition during said extended periods of reduced current flow by application of heat to said bottom for purposes of heating said cell. (Claim 1, lines 16-18; claim 10, lines 20-22).

Claims 1 and 10 do not recite an air sweep (or any other specific heating means) or recite any structural limitations regarding the placement of a heating means. Claims 1 and 14 only limit the heating means to applying heat to the bottom of the cell liner. As seen in Figure 2 of the Weaver reference the heating means is centrally located within the cell. Due to mechanisms of heat transfer, the heating means would transfer heat radially outward from the heating means, thus heating all portions of the electrolytic cell, including the bottom of the cell. This is affirmed by Weaver's disclosure that the heating means is used to prevent the electrolyte from freezing; the majority of the electrolyte is located below the heating mans, implying that heat is transferred in a downward direction towards the bottom of the cell. Additionally, the Examiner deems claims 1 and 10, as well as 18 and 27, obvious in view of the other secondary references, which expressly teach advantages to providing an air sweep at the bottom, outer surface of the cell liner.

ii. The Weaver reference teaches a different method of agitation (XJI.B, pages 21-22)

On page 21, Appellant states that Weaver uses a rotating anode to produce agitation in the bath, and Applicant's invention does not use a hollow anode that rotates to produce agitation. Claims 1-43 of the instant invention requires oxygen bubbles to be generated at the anodes and electrolyte to be stirred by the bubbles.

The Beck paper discloses, "The electrode height is the most important factor in determining the bath circulation rate by oxygen bubbles evolved at the anode (see Beck paper, p. 358, beginning at second to last line in col. 1). Since Weaver teaches the use of an indestructible anode (see US ‘340, p.1, col. 1, line 4) as well as the performance of the same reaction using the same electrolyte as Beck, oxygen bubbles would also be generated in the method of Weaver. Oxygen bubbles have a lower density than cryolite or aluminum, and would naturally rise to the surface, thus stirring the electrolyte. Therefore, in both references, oxygen bubbles provide agitation to the electrolyte.

iii. Suggestion to combine the Beck and Weaver references (XII.B, pages 22-23)

Appellant states that there is no suggestion to modify or combine the Beck or Weaver references because "essential steps of Applicant's invention are missing in the references (see Appellants Brief, p. 22, beginning in the last paragraph).

Regarding the use of a plurality of anodes and a plurality of cathodes recited in claims 1-43, the Beck paper itself provides motivation for their use by stating, "Operation with multiple, vertical, monopolar, metal anodes and TiB_2 plate cathodes . . . promises a 20-fold decrease in cell volume compared to conventional [Hall-Heroult] cells" (see p. 355, Abstract). Furthermore, one skilled in the art would have been motivated to modify the experimental, scaled-down cell of Beck to use a plurality of, anodes and cathodes because the use of a plurality of anodes and cathodes increases the available surface area, which provides a greater area on which the reaction can take place and increases the production of aluminum.

Regarding claims 1 and 10, Weaver discloses the steps of periodically reducing the current flow to the cell and applying heat to the cell during the reduced periods of current flow to prevent the freezing of the electrolyte (see US '340, p. 3, col. 2, lines fit 74). Therefore, Weaver provides teachings and suggestions for operating the cell intermittently and applying heat to maintain the electrolyte in a molten condition.

Regarding the general placement of the heat in claim claims 1 and 10 and the specific use of an air sweep in claims 18 and 27, Weaver suggests the heating of a cell to prevent the electrolyte from freezing, and the additional secondary references suggests motivation for the placement of an air sweep in relation to the cell.

C. The Berclaz Reference (XII. C, pages 23-26)

i. The use of the air sweep (XII. C, pages 23-25)

Appellant states, "Berclaz is concerned with a different cell than that of Applicant" (page 23 of Appellant's Brief, beginning in the last paragraph. In support, Appellant cites a passage of the Berclaz reference including the phrases "to adjust the temperature of the cathode and "the surface of the cathode mass 32 can be cooled to make the electrolyte contacting it form a protective paste (see WO ‘120, p. 26, lines 25-36).

The Examiner acknowledges that the arrangement of the elements in the Berclaz reference is different from the arrangement of the elements. However, Berclaz, Beck and Weaver all teach methods of electrolytically producing aluminum from alumina using anodes and cathodes to drive the electrolytic reaction. In addition, Weaver teaches and provides motivation for operating the electrolytic cell intermittently and heating the electrolyte to prevent it from freezing during periods when power is not applied (see US `340, p. 3, col. 2, lines 64-74). The reference of Berclaz is therefore relied upon for the teaching of heater placement within the electrolytic cell. Berclaz teaches that the temperature can be adjusted by applying a heating or cooling gas to the space (52 located underneath the cell liner (31) (see WO `120 Figure 6; p. 26; lines 25-36).

Furthermore, in regard to claims 18 and 27, the passage in the Berclaz reference cited by Appellant exemplifies the manner in which apparatuses of Berclaz, Weaver and the instant invention operate. Each of the apparatuses heats the electrolyte through an intervening member. In both Berclaz and the instant invention, a heat source (air sweep) generates heat that passes through the cell liner. Specifically, Berclaz discloses, "[I]t is possible to adjust the temperature of the cathode 30 . . . by supplying a heating or cooling gas to the space 52 . . . [and] the surface of the cathode mass 32 can be cooled to make the electrolyte contacting it form a paste (see WO `120, p. 26, lines 29-36). Turning the electrolyte into a paste requires cooling the electrolyte, which is accomplished by cooling the liner through the use of a cooling gas. Therefore, Berclaz teaches controlling the temperature of the electrolyte through the use of an air sweep.

On page 25 of Appellant's Brief, Appellant states:

> In Applicant's invention, heat is added or removed through the metal bottom of the cell. This is not disclosed in Berclaz. (see page 25 of Appellant's Brief, beginning in the first paragraph)

Berclaz teaches, "[I]t is possible to adjust the temperature of the cathode 30 (shell 31 and cathode mass 32) by supplying a heating or cooling gas to the space 52" (see WO '120, page 26, lines 29-32). The shell (31) is a metal shell that corresponds to the metal liner of Applicant's invention (see WO '120, p. 24, lines 1-2). Therefore, Berclaz expressly teaches adding or removing heat through the metal bottom of the cell.

ii. Suggestion to combine Beck, Weaver and Berclaz (XII. C, pages 25-26)

Appellant states, "[T]here is no suggestion to combine Beck, Weaver and Berclaz, that there is no expectation of success, and all the claim limitations have not been disclosed in these references" (see Appellant's Brief, p. 26, second full paragraph).

Beck teaches all of the limitations recited in claims 1, 10, 18 and 27 of the instant invention, except for the following, a plurality of anodes (claims 1, 10, 18 and 27), periodically reducing the current flow to the cell (claims 1 and 10), maintaining the electrolyte in a molten condition during the extended periods of reduced current flow by the application of heat to the bottom of the cell (claims 1 and 10), removing heat from the cell through the bottom of the liner by passing an air sweep from outside the cell over an outer surface of the bottom of the cell (claims 18 and 27), and using a controller to control the air sweep (claim 27). The abstract of the Beck paper provides motivation for using a plurality of anodes (see Beck paper, p. 355, Abstract).

Regarding claims 1 and 10, Weaver discloses the steps of periodically reducing the current flow to the cell and applying heat to the cell during the reduced periods of current flow to prevent the freezing of the electrolyte (see US `340, p. 3, col. 2, lines 61-74). Therefore, Weaver provides teachings and suggestions for operating the cell intermittently and applying heat to maintain the electrolyte in a molten condition.

Regarding claims 1, 10, 18 and 27, Berclaz teaches adding or removing heat from the bottom of the cell using an air sweep (see WO `120, p. 26, lines 25-36). Berclaz also provides motivation for using an air sweep to supply or remove heat because the air space acts as a thermic insulating space" (see WO `120, p. 26, lines 25-29). This teaching is consistent with both the teachings of Beck, who discloses the use of a "firebrick insulated steel shell" (see Beck paper, p. 359, col.1, first paragraph), and the teachings of Weaver, who discloses that the exterior walls are insulating (see US `340, p. 2, col.1, lines 27-39). In each reference, the electrolytic reaction takes place at much higher temperatures than ambient temperatures, and insulation is desired to retain heat within the reaction cell. However, as both Weaver and Berclaz suggest, cooling is also desired to maintain the temperature of the cell. Passing current through the cell heats the cell and can raise the temperature to undesired levels (see US '340, p. 3, col. 2, lines 53-60).

Regarding the use of a controller in claim 27, Weaver maintains "a proper temperature control within very close limits by using a temperature sensor and controller (page 4, col. 1, lines 1-26). The use of a temperature controller would have been obvious to one of ordinary skill in the art because the use of a controller allows the temperature to be maintained at the desired operating conditions. Beck, Weaver, and Berclaz each disclose operating the electrolytic cell at specific operating conditions. Since the operation of the cell itself affects the temperature of the electrolyte, the use of a controller would be consistent with the operation of each of the references. Furthermore, Beck discloses the use of a thermocouple for continuous temperature measurements (see Beck paper, p. 359, col. 2, first paragraph.

D. No suggestion or motivation (XII. D, pages 26-27)

i. References teach away from Applicant's invention (XII.D, pages 26-27)

Appellant states that the references teach away from Applicant's invention for the following reasons: the Beck paper teaches the use of "a 'firebrick insulated steel shell' which would prevent heating through the metal bottom" (see Appellants Brief, p. 26, last paragraph; Weaver teaches that the transfer of heat "through the bottom is reduced to 'substantial minimum'" (see

Appellant’s Brief, p. 27, first paragraph); and Berclaz does not teach "heating under reduced electrical current operation as in Applicant’s process" (see Appellant’s Brief, p. 27, second paragraph).

Regarding Beck's use of a firebrick insulated steel shell, each of the references relied upon discloses teaches insulating the entire cell. In each of the references, aluminum is produced at elevated temperatures (minimum of 750°C). Furthermore, Weaver and Berclaz also teach heating and cooling the electrolyte through the use of heating mechanisms; both references also teach that the entire cell should be insulated. Thermal insulation is used in electrolytic cells to maintain temperatures and to prevent the loss of heat to the atmosphere. Berclaz expressly teaches that an air sweep is used because the air space "acts as an thermic insulating space" between the cell liner and the refractory blocks that surround the apparatus (see WO '120, p. 26, lines 25-29). Therefore, since the Beck paper requires a heating means and an insulating shell to insulate the apparatus, the teachings of Weaver and Berclaz are consistent with the teachings of Beck.

E. No expectation of success (XII.E, pages 21-28)

Appellant states, "[T]he references are either *silent,* teach away from, or are concerned with different processes, there can be no reasonable expectation of success" (see Appellant’s Brief, p. 28, first paragraph).

Beck, Weaver and Berclaz all teach methods of electrolytically producing aluminum from alumina using cells containing anodes and cathodes. The production of aluminum occurs by the same process. In addition, each of the references teaches the addition of heat and operating the cell while the electrolyte is in a molten condition. Beck discloses the addition of heat to melt the electrolyte and then performing electrolysis (applying a current) for a set period of time (see Beck, p. 359, col. 2). Weaver teaches the intermittent operation of the aluminum-producing electrolytic cell to take advantage of off-peak power and the application of heat while power is not supplied (see US `340, p. 3, col. 2, lines 61-74). Therefore, Beck and Weaver both teach the application of heat and the non-continuous application of current. Beck and Weaver also teach the insulation of the electrolytic apparatus to prevent the loss of heat. Berclaz teaches a similar method of electrolytically producing aluminum from alumina. Berclaz teaches the application of heat using an air sweep positioned at the bottom the cell to provide heat and also provide insulation (see WO ‘120, p. 26, lines 25-36). Since each of the references teach similar methods and are used to perform the same process of electrolytically producing aluminum using the application of heat and current, one skilled in the art would reasonably expect success in the combination of the references.

F. Cannot provide all of the limitations of the claims (XII.F, pages 28-29)

Appellant states, "[T]he Beck Paper, Weaver, and Berclaz do not and cannot suggest *all* the limitations of the claims because the Beck Paper is silent with respect to periods of reduced electrical current flow to the cell and the application of heat to the metal bottom of the cell during periods of reduced current flow (see Appellant's Brief, p. 28, first full paragraph). Appellant further states that "teaching or suggestion" and the "reasonable expectation for success" must be found in the prior art.

First, Examiner acknowledges that Beck does not teach all of the limitations of the instant claims. However, as explained above, Weaver and Berclaz teach the limitations that Beck is silent towards, and provide teachings and suggestions to combine the limitations in the method of Beck. Therefore, one of ordinary skill in the art at the time the invention was made would have been motivated to use the teachings of Weaver and Berclaz in the method of Beck because Weaver and Berclaz suggest reasons to use the modifications.

G. No suggestion to make the combination (XII.G, page 29-37)

i. Application of heat to the bottom of the cell (XII.G, page 29)

Appellant states, "The Beck Paper and Weaver make no mention of applying heat to the metal bottom of the cell during periods of reduced current flow" (see Appellant's Brief, p. 29, first full paragraph).

Weaver discloses a heating mechanism that radiates heat in all directions, especially the downward direction towards the electrolyte and the bottom of the cell to maintain the electrolyte in a molten state (see US '340, fig. 2; p. 3, cot. 2, lines 61-74). Additionally, the rejection set forth in the prior Office actions further relied on the reference of Berclaz, which expressly teaches the application of heat to the bottom of the electrolytic cell to control the temperature (see WO ‘120, fig. 6; p. 26, lines 25-36). Berclaz also provides motivation for using an air sweep positioned at the bottom of the cell (see WO `120, p. 26, lines 25-36). Therefore, one skilled in the art would have been motivated to provide heat to the bottom of an aluminum-producing, electrolytic cell.

ii. Avoiding the high cost of electricity is missing the prior art (XII.G, page 30)

Appellant states, "Applicant’s steps for operating an electrolytic cell for producing aluminum to avoid the high cost of electricity are missing in the prior art references (see Appellant’s Brief, p. 30, last paragraph. Weaver expressly teaches the intermittent operation of an aluminum-producing electrolytic cell (see US `340, p. 3, col. 2, lines 61-74). In addition, Weaver expressly states that the desirable working conditions "include the use of so-called ‘off-peak power’" (see US `340, p. 3, col. 2, lines 61-65). Therefore, Weaver clearly provides, the motivation for one skilled in the art to operate an electrolytic cell intermittently to take advantage of off-peak power.

iii. Picking and choosing parts of references (XII.G, page 39)

Appellant states, [T]he Examiner picks and chooses only parts of these references and ignores the fair teachings of the references" (see Appellant’s Brief, p. 31, last paragraph.

Beck, Weaver and Berclaz teach methods and apparatuses for electrolytically producing aluminum using electrolytic cells. Each of the references provides a source of heat to control the temperature of the electrolyte and also the capability to apply an electric current. One of ordinary skill in the art recognizes that methods are capable of being used in other apparatuses and that a rearrangement of parts to achieve the same result is obvious. More particularly, the references of Weaver and Berclaz provide clear motivation for modifying the method of Beck. Beck, Weaver and Berdaz all teach, the method of electrolytically producing aluminum, and in each case, the apparatus of each reference is capable of using the method of the other because they recognize the need to supply a current to the cell and to provide a heat source to control the temperature of the electrolyte. Therefore, the fair teachings of the references teach and suggest the intermittent operation of an electrolytic cell and the application of heat to the bottom of the cell.

iv. Beck et al. ago not provide parts missing (XII.G, pages 33-35)

Appellant states, "Beck et al. '701 does not provide parts missing in the Beck Paper, Weaver and Berclaz (see Appellant's Brief, p. 33, third paragraph). This statement applies to the metallic liner.

The Beck paper teaches the use of a metallic liner (see Beck paper, p. 359, col. 1). The reference of Beck et al. was relied upon to disclose the desirable size of aluminum particles used in electrolytic aluminum production cells. Therefore, since the Beck paper teaches Appellant's "missing parts", the Beck patent is not required to supply what is already present. One skilled in the art would recognize that the teachings of the desired particle size in the Beck patent are relevant to any aluminum producing electrolytic cell regardless of the cell layout.

v. Claims 35-37 and 40-43 patentable over combination (XII. G, page 35-37)

Appellant states, "Applicant's invention as set forth in the claims is patentable over the Beck paper taken singly or combined with Steiger or Berclaz" (see Appellant’s Brief, p. 36, last paragraph. In support, Appellant relies upon structural differences in the references.

The Examiner acknowledges that the Beck paper is silent with regard to applying heat to the bottom of the metal liner, and the Beck paper further teaches the use of an insulating material surrounding the electrolytic apparatus. However, Berclaz teaches the use of a heating mechanism comprising an air sweep positioned beneath the bottom the cell liner and teaches that the air space is also used for insulation (see WO `120, p. 26, lines 25-36). Therefore, Berclaz clearly provides motivation for combining the heating mechanism of Berclaz with the method of the Beck paper because it provides both the heating function required in the Beck paper and also provides additional insulating function as desired in the Beck paper. The method of Steiger is relied upon to show the equivalence of the order in which the method steps are performed one skilled in the art would recognize that the teaching of method step order in Steiger is relevant to any aluminum-producing electrolytic cell regardless of cell layout.

H. The Steiger Reference (XII.H, pages 38-41)

i. Steiger is concerned with a method of internally heating a cell (XII.H, page 38)

Appellant states that Applicant's invention is patentable over the prior art because Steiger teaches the application of heat inside the cell (see Appellant’s Brief, p. 38, first paragraph).

Regarding claims 35-37 and 40-43, the Beck paper, Berclaz and Steiger all teach the process of electrolytically producing aluminum from alumina. Additionally, Beck, the primary reference, discloses the following method including a startup method:

> Heatup to operating temperature of 750°C and complete melting of electrolyte took five hours. Two hours of electrolysis at 300 amperes followed. (see Beck paper, p. 359, col. 2, second paragraph)

The Beck paper does not explicitly disclose whether the electrolyte was added to the cell before or after it was melted. Since the entire cell operates at the operating temperature, the addition of solid electrolyte before melting is implied. However, the Steiger reference was relied upon to show that the order in which the heating and addition takes place is irrelevant. Steiger teaches, "The cell chamber is charged with molten aluminum and electrolyte . . . [or] the cell is charged before heat-up with powdered electrolyte, e.g., solid cryolite, which melts as the cell is heated to its operating temperature" (see US ‘583, col. 13, lines 5-13). One skilled in the art would recognize that the teachings of Steiger could be used in any aluminum-producing electrolytic cell because only two startup methods exist for such cells, melting before or after addition, and Steiger teaches that they can be equivalently used.

ii. Differences in recited method (XII.H, pages 40-41)

Regarding claim 35, Appellant states that Berclaz differs from the Applicant's invention because "the cathode *is cooled during operation to form a protective paste*" (see Appellant's Brief, p. 40, last paragraph.

The formation of a protective pastels a temperature dependant function of the electrolyte. Therefore, the ability of the heating mechanism of Berclaz to form a protective paste demonstrates the ability to control temperature of the electrolyte. Thus, the heating mechanism of Berclaz is capable of performing the function of controlling the temperature of the electrolyte by cooling or heating.

J. Advisory Action and Conclusion (XIII and XIV, pages 42-44)

Appellant restates positions taken previously with regard to the differences in structure between the prior art references. Appellant insists that the structural differences prevent the combination of the references.

Each of the references relied discloses a method of electrolytically producing aluminum from alumina using anodes and cathodes. In addition, the Beck paper, Weaver and Berclaz all suggest the application of heat to the electrolyte and the application of current to perform the electrolysis reaction. Thus, the apparatus of each of the references is capable of performing the method claimed by the Applicant.

Regarding claims 1-17, which require the periodic reduction of current flow to the cell and the application of heat to the cell to maintain the electrolyte in a molten condition, Weaver expressly teaches that off-peak power can be used advantageously to produce aluminum in an electrolytic cell and that the electrolyte should be heated to prevent the electrolyte from freezing (see US `340, p. 3, col. 2, lines 61-74). The Beck, paper also provides a method of producing aluminum electrolytically and requires the addition of heat and the timed application of current (see Beck paper, p. 359, col. 2). One skilled in the art would have been motivated by the teachings of Weaver that off peak power could advantageously be used in the method of Beck by operating the cell intermittently and preventing the freezing of the electrolyte by the application of heat. The position of the heater is riot relevant in claims 1-17, which only require the application of heat to the bottom of the liner. The heating mechanism of Weaver radiates heat in all directions, including the bottom of the cell where the electrolyte is located (see US `340, fig. 2). In addition, Berclaz teaches the placement of a heating mechanism at the bottom of the cell because it provides the advantages of insulating the cell when heating or cooling is not required. Therefore, the different rearrangement of components in the prior art references show that the step of applying heat to the electrolyte is capable of being performed regardless of the location of the heating mechanism.

Regarding claims 18-43, which do require certain structural features, specifically the use of an air sweep positioned below the bottom surface of the metal cell liner, the Berclaz reference expressly teaches that an air sweep provides the ability to heat and cool, as well as provide additional insulation when air is not passed through the space (see WO `120, p. 26, lines 25-36). The Beck paper requires a cell having a metal liner and insulation surrounding the apparatus (see Beck paper, p. 359, col.1). Beck also requires the addition of heat (see Beck paper, p. 359, col. 2). Therefore, one skilled in the art would have been motivated to use the air sweep of Berclaz, which is positioned below the bottom of the metal liner, in the method of Beck because it provides heat to the cell and also insulates the cell to prevent heat loss. One skilled in the art would recognize that the heating mechanism of Berclaz would be beneficial in any electrolytic cell having a metal liner and used in a method requiring the addition of heat. Therefore, the structural differences between Berclaz and Beck are irrelevant.

Regarding claims 35-43, which requires the addition of heat to the bottom of the cell liner and the placement of a heater adjacent the cell bottom, the prior art references teach all of the limitations of the claims. The Beck paper describes a startup method requiring steps of adding electrolyte to the cell tan inherent step), heating the cell, completely melting the electrolyte, and applying a current to generate oxygen bubbles at the anodes and aluminum at the cathodes (see Beck paper, p. 358, col. 1, beginning at last paragraph; p. 359, col. 2). The method of Beck differs from the instant claims because Beck does not explicitly disclose where the heater is located or the order in which the heat is applied and the electrolyte is added. Steiger teaches a method of electrolytically producing aluminum and teaches that either molten electrolyte may be added to the cell, or powdered electrolyte may be added and then melted (see US `583, col.13, lines 5-13). Regarding the placement of the heater, Berclaz teaches that placement of the heater at the bottom of the cell is advantageous because it also provides insulation to the cell to prevent heat loss (see WO 120, p. 26, lines 25-36). One skilled in the art would have been motivated to combine the references Beck Berclaz and Steiger because the teachings of the prior art suggest advantages to the combination. One skilled in the art would recognize that the rearrangement of the components in each reference does not affect the Method of producing aluminum taught by the prior art.

III. Our analysis

We incorporate the examiner's comments as our own and affirm each of the rejections.

IV. Conclusion

Each of the art rejections is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 CFR § 1.136(a).

AFFRIMED

CATHERINE TIMM Administrative Patent Judge	)	
	)	BOARD OF PATENT
JEFFREY T. SMITH Administrative Patent Judge	)	APPEALS AND INTERFERENCES
	)	
BEVERLY A. PAWLIKOWSKI Administrative Patent Judge	)	

BAP/sld

Appeal No. 2004-1043
Application No. 09/960,907

ANDREW A.EXANDER
ANDREW ALEXANDER & ASSOCIATES
3124 KIPP AVENUE
P.O. BOX 2038
LOWER BURRELL, PA 15068